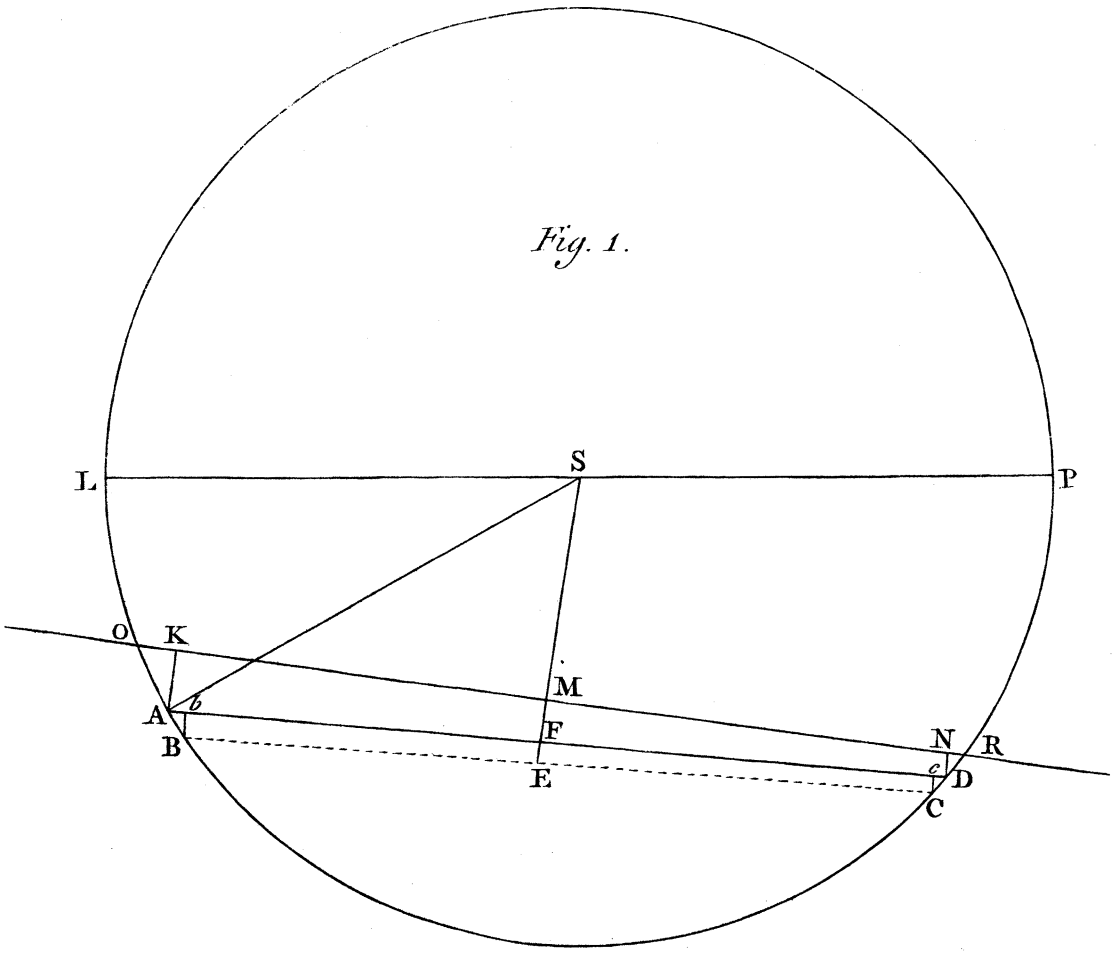
XLVII. *Second Paper concerning the Parallax of the* Sun *determined from the Obſervations of the late Tranſit of* Venus, *in which this Subject is treated of more at length, and the Quantity of the Parallax more fully aſcertained. By* James Short, *M.A. and F.R.S.*

Read Dec. 8, 1763.

IN the laſt volume of the Memoirs of the Royal Academy at Paris for the year 1761, there is a Memoir by M. Pingré, who went to the iſland of Rodrigues, and obſerved the tranſit of Venus there; in this memoir M. Pingré endeavours to determine the parallax of the Sun, by the obſervation of the late tranſit of Venus, to be = 10″. both by the obſerved durations, the leaſt diſtance of the centers, and by the internal contact at the egreſs; and ſeeems to think that there muſt be ſome miſtake in the obſervation of Mr. Maſon at the Cape of Good Hope, particularly with regard to the difference of longitude between Mr. Maſon's obſervatory and Paris, becauſe by comparing the obſervation of Mr. Maſon at the Cape with the European obſervations, he finds the parallax of the Sun, from thence reſulting, to be between 8″ and 9″, conſequently differing from the determination by the obſervation at Rodrigues when compared with the ſame places. I ſhall therefore, in this paper, endeavour to prove, beyond all doubt, by a compariſon of the obſervations

Fig. 1.



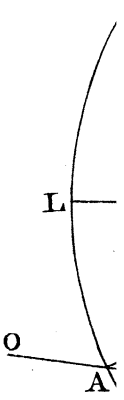
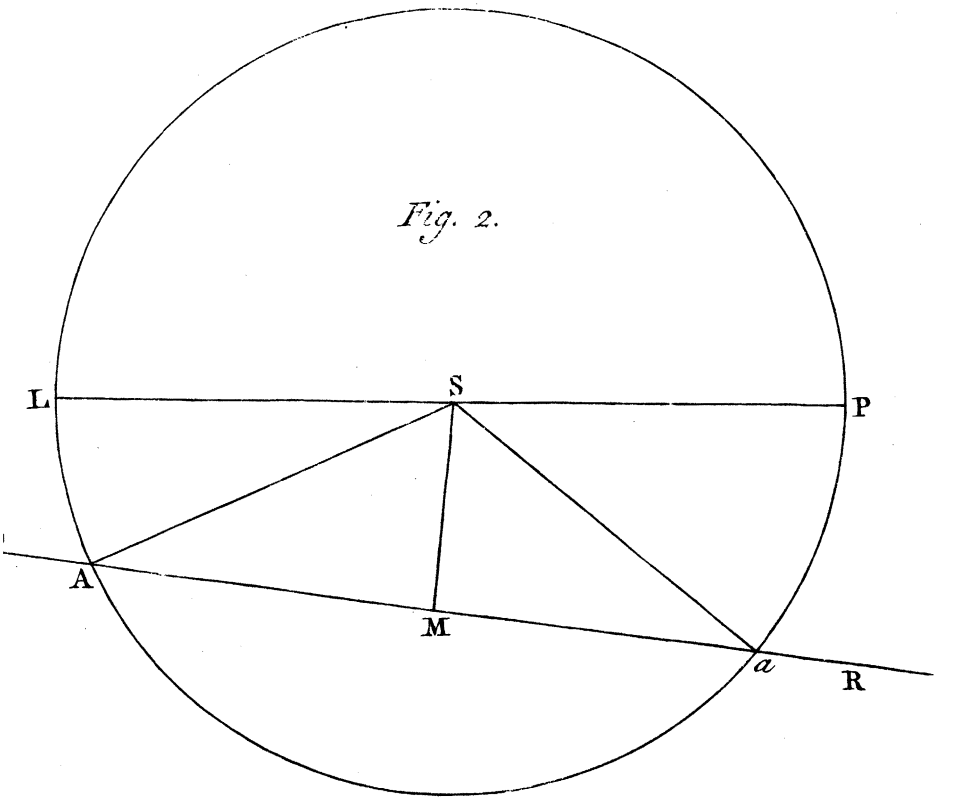


Fig. 2.



obſervations on this ſide of the Equinoctial Line alone, that the Sun's parallax is between 8″ and 9″, and that this determination is the ſame or very nearly the ſame, as when the obſervation at the Cape is compared with the ſame places. I ſhall alſo endeavour to prove, that there is a miſtake of one minute in time in writing down the time of the internal contact at the egreſs at Rodrigues, and that this being corrected, the reſults of the Sun's parallax, by a compariſon of the obſervation at Rodrigues with the obſervations at the ſeveral places on this ſide of the *Line*, is the ſame with that which reſults from all the reſt; and this agreement is alſo an argument that there muſt have been ſuch a miſtake in ſetting down the time of the internal contact at the egreſs at Rodrigues. I ſhall alſo ſhew that the parallax of the Sun, determined from the obſerved durations, and from the leaſt diſtance of the centers is very nearly the ſame as that which is determined from the internal contact at the egreſs, though theſe laſt determinations cannot be ſo much depended on becauſe of the minute elements from which they are drawn.

I ſhall therefore proceed to compare the obſervations of the internal contact made on this ſide of the *Line* only, and from thence determine the Sun's parallax. In order to do this it is neceſſary that the differences of longitude between the places of obſervation, compared together, be well aſcertained: and in the doing of this, in all places where the ingreſs was obſerved, I have been much obliged to a very ingenious method, propoſed by M. Pingré in his aforeſaid Memoir, to which I refer; and for the longitudes of other places I have conſulted the Philoſophical Tranſ-

actions and the *Connoiſſance des Temps*. Theſe differences of longitude are as follow.

	h	′	″	
Tobolſk and Abo - - - - - - =	3	4	37	Weſt.
Bologna - - - - =	3	47	46	W.
Calcutta - - - - =	1	20	38	Eaſt.
Cajaneburg - - - =	2	42	12	W.
Calmar - - - - - =	3	27	32	W.
Cape of G. Hope =	3	19	32	W.
Florence - - - - =	3	49	3	W.
Gottingen - - - =	3	53	35	W.
Grand Mount - - =	0	46	26	E.
Greenwich - - - =	4	33	7	W.
Hernoſand - - - =	3	21	55	W.
Leſkeard - - - - =	4	51	39	W.
Madraſs - - - - =	0	47	11	E.
Paris - - - - - - =	4	23	51	W.
Rodrigues - - - =	0	20	25	W.
Rome - - - - - =	3	43	14	W.
* Savile-houſe, Lond. =	4	33	37	W.
Stokolm - - - - =	3	20	41	W.
Tornea - - - - - =	2	56	7	W.
Tranquebar - - - =	0	46	9	E.
Upſal - - - - - - =	3	22	40	W.

I have deviated from the above mentioned method of M. Pingré in ſettling the longitude of Stokolm, by

* The latitude of Savile-houſe, London, is = 51° 30′ 50″ N. The latitude of Florence is = 43° 46′ 30″ N. and that of Gottingen = 51° 31′ 54″ N. The latitudes of the reſt of the places are ſet down in my former paper on this ſubject, only that of Tranquebar ſhould be = 11° 30′ 0″.

the

the ingreſs, becauſe it appears clear to me that there muſt have been a miſtake in the obſervation of the internal contact at the ingreſs at Stokolm, owing, as I mentioned in my former paper, to the ſmall altitude of the Sun at the time of the ingreſs: for by comparing the times of ingreſs and egreſs obſerved at Stokolm and Upſal, we find that the difference of longitude between theſe two places is $1' 39''$, and $1' 59''$, and as we are ſure that the obſervation at the egreſs, gives the difference of longitude the moſt certain in this caſe, therefore it follows that the error was at the ingreſs, and it is eaſy to prove that the error is in the obſervation at Stokolm.

To avoid all uncertainty, and to be as clear and diſtinct as poſſible, I ſhall ſet down, in the following table, the obſervation at the egreſs at each place compared, the difference of longitude between each place compared, the effect of the parallaxes reſulting from the compariſon, and alſo the effect of the parallaxes computed on a ſuppoſition that the Sun's parallax is $= 8'' 5$, in order, that if there is any miſtake, it may, the more eaſily, be diſcovered.

I compare Cajaneburg with 18 places, Bologna with 17 places, and Tobolſk with 18 places, and they are as follow.

h ′ ″		′ ″	h ′ ″		′ ″
10 7 59	Cajan.	2 59 C.	10 7 59	Cajan.	2 59 C.
0 38 29	= D. M.	2 18 S.	0 40 28	= D. M.	2 21 U.
9 29 30		41	9 27 31		38
9 30 11	Stokolm.		9 28 9	Upſal.	
41			38		
	Par.	= 8″. 50		Par.	= 8″. 50

10 7

h	′	″			′	″		h	′	″			′	″	
10	7	59	Cajan.		2	59	C.	10	7	59	Cajan.		2	59	C.
0	22	25	= D. M.		2	30	A.	0	45	20	= D. M.		1	59	C.
9	45	34				29		9	22	39				1	0
9	45	59	Abo.					9	23	40	Calmar.				
		25						0	1	1					
				Par. =		″	7. 33					Par. =		″	8 64

h	′	″			′	″		h	′	″			′	″	
10	7	59	Cajan.		2	59	C.	10	7	59	Cajan.		2	59	C.
0	39	43	= D. M.		2	26	H.	2	42	12	= D. M.		3	44	T.
9	28	16				33		12	50	11				45	
9	28	52	Hernoſand.					12	49	23	Tobolſk.				
0	0	36						0	0	48					
				Par. =		″	9 27					Par. =		″	9. 06

h	′	″			′	″		h	′	″			′	″	
10	7	59	Cajan.		2	59	C.	10	7	59	Cajan.		2	59	C.
1	11	23	= D. M.		1	18	G.	1	50	55	= D. M.		1	12	G.
8	56	36				1 41		8	17	4				1 47	
8	58	26	Gottingen.					8	19	0	Greenwich.				
0	1	50						0	1	56					
				Par. =		″	9. 25					Par. =		″	9. 09

h	′	″			′	″		°	′	″			′	″	
10	7	59	Cajan.		2	59	C.	10	7	59	Cajan.		2	59	C.
1	51	25	= D. M.		1	11	S.H.	2	9	27	= D. M.		1	4	L.
8	16	34				1 48		7	58	32				1 55	
8	18	22	Savile-houſe.					8	0	21	Leſkeard.				
0	1	48						0	1	49					
				Par. =		″	8. 50					Par. =		″	8. 06

☉	′	″			′	″	♄	′	″			′	″
10	7	59	Cajan.		2	59 C.	10	7	59	Cajan.		2	59 C.
1	41	39	= D. M.		0	53 P.	1	5	34	= D. M.		0	29 B.
9	26	20			2	6	9	2	25			2	30
9	28	25	Paris.				9	4	54	Bologna.			
0	2	5					0	2	29				
			Par. =		8.	43				Par. =		8.	44
♄	′	″			′	″	♄	′	″			′	″
10	7	59	Cajan.		2	59 C.	10	7	59	Cajan.		2	59 C.
1	1	2	= D. M.		0	13 R.	1	6	51	= D. M.		0	24 F.
9	6	57			2	46	9	1	8			2	35
9	9	36	Rome.				9	3	28	Florence.			
0	2	39					0	2	20				
			Par. =		8.	14				Par. =		7.	68
♄	′	″			′	″	♄	′	″			′	″
10	7	59	Cajan.		2	59 C.	10	7	59	Cajan.		2	59 C.
4	2	50	= D. M.		2	22 C.	3	28	38	= D. M.		1	0 G. M.
14	10	49			0	37	13	36	37			1	59
14	11	34	Calcutta.				13	38	30	G. Mount.			
0	0	45					0	1	53				
			Par. =		10.	34				Par. =		8.	07
♄	′	″			′	″	♄	′	″			′	″
10	7	59	Cajan.		2	59 C.	10	7	59	Cajan.		2	59 C.
3	28	21	= D. M.		0	52 T.	3	29	23	= D. M.		1	0 M.
13	36	20			2	7	13	37	22			1	59
13	38	25	Tranquebar.				13	39	38	Madraſs.			
0	2	5					0	2	16				
			Par. =		8.	36				Par. =		9.	71

h ′ ″		′ ″
9 4 54	Bologna	0 29 B.
0 27 5	= D. M.	2 18 S.
9 31 59		1 49
9 30 8	Stokolm.	
0 1 51		

Par. = 8. 65

h ′ ″		′ ″
9 4 54	Bologna	0 29 B.
0 25 5	= D. M.	2 21 Up.
9 29 59		1 52
9 28 9	Upſal.	
0 1 50		

Par. = 8. 35

h ′ ″		′ ″
9 4 54	Bologna	0 29 B.
0 43 9	= D. M.	2 30 A.
9 48 3		2 1
9 45 59	Abo.	
0 2 4		

Par = 8. 71

h ′ ″		′ ″
9 4 54	Bologna	0 29 B.
0 20 14	= D. M.	1 59 C.
9 25 8		1 30
9 23 40	Calmar.	
0 1 28		

Par. = 8. 31

h ′ ″		′ ″
9 4 56	Bologna	0 29 B.
0 25 51	= D. M.	2 26 H.
2 30 47		1 57
9 28 52	Hernoſand.	
0 1 55		

Par. = 8. 36

h ′ ″		′ ″
9 4 54	Bologna	0 29 B.
3 47 46	= D. M.	3 44 T.
12 52 40		3 15
12 49 23	Tobolſk.	
0 3 17		

Par. = 8. 58

h ′ ″		′ ″
9 5 0	Bologna	0 29 B.
0 5 49	= D. M.	1 18 G.
8 59 11		0 49
8 58 26	Gottingen.	
0 0 45		

Par. = 7. 80

h ′ ″		′ ″
9 5 0	Bologna	0 29 B.
0 45 21	= D. M.	1 12 G.
8 19 39		0 43
8 19 0	Greenwich.	
0 0 39		

Par. = 7. 71

h	′	″		′	″	h	′	″		′	″
9	4	54	Bologna	0	29 B.	9	4	54	Bologna	0	29 B.
0	45	51	= D. M.	1	11 S.H.	1	3	53	= D. M.	1	4 L.
8	19	3			0 42	8	1	1			0 35
8	18	22	Savile-Houſe.			8	0	21	Leaſkeard.		
0	0	41				0	0	40			
			Par. =		″ 8. 30				Par. =		″ 9. 71

h	′	″		′	″	h	′	″		′	″
9	4	54	Bologna	0	29 B.	9	5	0	Bologna	0	29 B.
0	36	5	= D. M.	0	53 P.	5	8	24	= D. M.	2	22 C.
8	28	49			0 24	14	13	24			1 53
8	28	25	Paris.			14	11	34	Calcutta.		
0	0	24				0	1	50			
			Par. =		″ 8. 50				Par. =		″ 8. 28

h	′	″		′	″	h	′	″		′	″
9	4	54	Bologna	0	29 B.	9	4	54	Bologna	0	29 B.
4	34	12	= D. M.	1	0 G.M.	4	33	55	= D. M.	0	52 T.
13	39	6			0 31	13	38	49			0 23
13	38	30	G. Mount.			13	38	25	Tranquebar.		
0	0	36				0	0	24			
			Par. =		″ 9. 87				Par. =		″ 8. 86

h	′	″		′	″	h	′	″		′	″
9	5	0	Bologna	0	29 B.	9	5	0	Bologna	0	29 B.
4	34	59	= D. M.	1	0 M.	0	51	39	= D. M.	3	5 T.
13	39	59			0 31	9	56	39			2 36
13	39	38	Madraſs.			9	54	8	Tornea.		
0	0	21				0	2	31			
			Par. =		″ 5. 76				Par. =		″ 8. 23

h 12 49 23 Tobolſk 3 44 T. 3 20 41 = D. M. 2 18 S. 9 28 42 1 26 9 30 8 Stokolm. 0 1 26 Par. = 8. 50	h 12 49 23 Tobolſk 3 44 T. 3 22 40 = D. M. 2 21 U. 9 26 43 1 23 9 28 9 Upſal. 0 1 26 Par. = 8. 80
h 12 49 23 Tobolſk 3 44 T. 3 4 37 = D. M. 2 30 A. 9 44 46 1 14 9 45 59 Abo. 0 1 13 Par. = 8. 40	h 12 49 23 Tobolſk 3 44 T. 3 27 32 = D. M. 1 59 C. 9 21 51 1 45 9 23 40 Calmar. 0 1 49 Par. = 8. 82
h 12 49 23 Tobolſk 3 44 T. 3 21 55 = D. M. 2 26 H. 9 27 28 1 18 9 28 52 Hernoſand. 0 1 24 Par. = 9. 02	h 12 49 23 Tobolſk 3 44 T. 3 53 35 = D. M. 1 18 G. 8 55 48 2 26 8 58 26 Gottingen. 0 2 38 Par. = 10. 57
′ 12 49 23 Tobolſk 3 44 T. 4 33 7 = D. M. 1 12 G. 8 16 16 2 32 8 19 0 Greenwich. 0 2 44 Par. = 9. 11	h 12 49 23 Tobolſk 3 44 T. 4 33 37 = D. M. 1 11 S. H. 8 15 46 2 33 8 18 22 Savile-Houſe. 0 2 36 Par. = 8. 66

h	′	″			′	″	h	′	″			′	″
12	49	23	Tobolſk	3	44	T.	12	49	23	Tobolſk	3	44	T.
4	51	39	= D. M.	1	4	L.	4	23	51	= D. M.	0	53	P.
7	57	44		2	40		8	25	32		2	51	
8	0	21	Leſkeard.				8	28	25	Paris.			
0	2	37					0	2	53				
			Par. =		8.	34				Par. =		8.	60

h	′	″		′	″	h	′	″		′	″
12	49	23	Tobolſk	3	44	T.	12	49	23	Tobolſk	3	44	T.
3	49	3	= D. M.	0	24	F.	3	43	14	= D. M.	0	13	R.
9	0	20		3	20		9	6	9		3	31	
9	3	28	Florence.				9	9	36	Rome.			
0	3	8					0	3	27				
			Par. =		7.	99				Par. =		8.	34

h	′	″		′	″	h	′	″		′	″
12	49	23	Tobolſk	3	44	T.	12	49	23	Tobolſk	3	44	T.
1	20	38	= D. M.	2	22	C.	0	46	26	= D. M.	1	0	G. M.
14	10	1		1	22		13	35	49		2	44	
14	11	34	Calcutta.				13	38	30	G. Mount.			
0	1	33					0	2	41				
			Par. =		9.	64				Par. =		8.	34

h	′	″		′	″	h	′	″		′	″
12	49	23	Tobolſk	3	44	T.	12	49	23	Tobolſk	3	44	T.
0	46	9	= D. M.	0	52	Tr.	0	47	11	= D. M.	1	0	M.
13	35	32		2	52		13	36	34		2	44	
13	38	25	Tranquebar				12	39	38	Madraſs.			
0	2	53					0	3	4				
			Par. =		8.	55				Par =		9.	54

I have explained the manner of this table in a former paper on this ſubject to which I refer. I ſhall now ſet down the reſult from each compariſon in the following order, that they may be the more eaſily ſeen.

Sun's Parallax.		Sun's Parallax.		Sun's Parallax.	
Cajan. and Stokolm	= 8″. 50	Bolog. and Stokolm	= 8″. 65	Tobolſk and Stokolm	= 8″. 50
Upſal - -	= 8. 50	Upſal - --	= 8. 35	Upſal - -	= 8. 80
Abo - -	= 7. 33	Abo - - -	= 8. 71	Abo - -	= 8. 40
Calmar -	= 8. 64	Calmar - -	= 8. 31	Calmar -	= 8. 82
Hernoſand -	= 9. 27	Hernoſand	= 8. 36	Hernoſand -	= 9. 02
Tobolſk -	= 9. 06	Tobolſk -	= 8. 58	Gottingen	= 10. 57
Gottingen -	= 9. 25	Gottingen	= 7. 80	Greenwich	= 9. 11
Greenwich -	= 9. 09	Greenwich	= 7. 71	Savile-Houſe	= 8. 66
Savile-Houſe	= 8. 50	Savile-Houſe	= 8. 30	Leſkeard -	= 8. 34
Leſkeard -	= 8. 06	Leſkeard -	= 9. 71	Paris - -	= 8. 60
Paris - -	= 8. 43	Paris - -	= 8. 50	Florence -	= 7. 99
Bologna -	= 8. 44	Calcutta -	= 8. 28	Bologna -	= 8. 58
Rome -	= 8. 14	G. Mount	= 9. 87	Rome -	= 8. 34
Florence -	= 7. 68	Tranquebar	= 8. 86	Calcutta -	= 9. 64
Calcutta -	= 10. 34	Madraſs -	= 5. 76	G. Mount -	= 8. 34
G. Mount	= 8. 07	Cajaneburg	= 8. 44	Tranquebar	= 8. 55
Tranquebar	= 8. 36	Tornea -	= 8. 23	Madraſs -	= 9. 54
Madraſs -	= 9. 71			Cajaneburg	= 9. 07

The mean of theſe 53 compariſons gives the Sun's Parallax = 8″, 61.

Rejecting all thoſe reſults which differ more than one ſecond from the mean of the whole, the mean of the remaining 45 reſults gives the Sun's parallax = 8″, 55.

Rejecting all thoſe reſults which differ more than half a ſecond from the mean of the whole, the mean of the remaining 37 reſults gives the Sun's parallax = 8″, 57.

The mean of theſe three means gives the Sun's parallax = 8″, 58.

I ſhall next compare the obſervations of the internal contact at the egreſs made at Paris, Greenwich, Savile-Houſe, Bologna, Madraſs, Grand Mount, and Tranquebar, with thoſe made at Stokolm, Upſal, Tornea,

Tornea, Cajaneburg, Tobolſk, Abo, Calmar, Hernoſand and Calcutta. They are as in the following table.

h ′ ″ 9 28 52 Hernoſand 2 26 H. 4 8 4 = D. M. 0 51 T. 13 36 56 1 35 13 38 25 Tranquebar. 0 1 29 Par. = 7. 96	h ′ ″ 14 11 34 Calcutta 2 22 C. 0 34 29 = D. M. 0 51 T. 13 37 5 1 31 13 38 25 Tranquebar. 0 1 20 Par. = 7. 47
h ′ ″ 8 28 27 Paris 0 53 P. 1 3 10 = D. M. 2 18 S. 9 31 37 1 25 9 30 10 Stokolm. 0 1 27 Par. = 8. 70	h ′ ″ 8 28 27 Paris 0 53 P. 1 1 11 = D. M. 2 21 U. 9 29 38 1 28 9 28 9 Upſal. 0 1 29 Par. = 8. 60
h ′ ″ 8 28 27 Paris 0 53 P. 1 27 44 = D. M. 3 5 T. 9 56 11 2 12 9 54 8 Tornea. 0 2 3 Par. = 7. 92	h ′ ″ 8 28 27 Paris 0 53 P. 1 19 14 = D. M. 2 29 A. 9 47 41 1 36 9 45 59 Abo. 0 1 42 Par. = 9. 03
h ′ ″ 8 28 27 Paris 0 53 P. 0 56 19 = D. M. 1 58 C. 9 24 46 1 5 9 23 40 Calmar. 0 1 6 Par. = 8. 63	h ′ ″ 8 28 27 Paris 0 53 P. 1 1 56 = D. M. 2 26 H. 9 30 23 1 33 9 28 52 Hernoſand. 0 1 31 Par. = 8. 42

h	′	″		′	″
8	28	27	Paris	0	53 P.
5	44	29	= D. M.	2	22 C.
14	12	56		1	29
14	11	34	Calcutta.		
0	1	22			

Par. = 7. 83

h	′	″		′	″
9	30	11	Stokolm	2	18 S.
1	12	26	= D. M.	1	12 G.
8	17	45		1	6
8	19	0	Greenwich.		
0	1	15			

Par. = 9. 66

h	′	″		′	″
9	28	9	Upſal	2	21 U.
1	10	27	= D. M.	1	12 G.
8	17	42		1	9
8	19	0	Greenwich.		
0	1	18			

Par. = 9. 61

h	′	″		′	″
9	54	8	Tornea	3	5 T.
1	37	0	= D. M.	1	12 G.
8	17	8		1	53
8	19	0	Greenwich.		
0	1	52			

Par. = 8. 42

h	′	″		′	″
9	45	59	Abo	2	29 A.
1	28	30	= D. M.	1	12 G.
8	17	29		1	17
8	19	0	Greenwich.		
0	1	31			

Par. = 10. 04

h	′	″		′	″
9	23	40	Calmar	1	58 C.
1	5	35	=D.M.	1	12 G.
8	18	5		0	46
8	19	0	Greenwich.		
0	0	55			

Par. = 10. 16

h	′	″		′	″
9	28	52	Hernoſand	2	26 H.
1	11	12	= D. M.	1	12 G.
8	17	40		1	14
8	19	0	Greenwich.		
0	1	20			

Par. = 9. 20

h	′	″		′	″
14	11	34	Calcutta	2	22 C.
5	53	45	= D. M.	1	12 G.
8	17	49		1	10
8	19	0	Greenwich.		
0	1	11			

Par. = 8. 62

h ′ ″ 9 30 11 Stokolm 2 18 S. 1 12 56 = D.M. 1 11 S.H. 8 17 15 1 7 8 18 22 Savile-Houſe. 0 1 7 Par. = ″8. 50	h ′ ″ 9 28 9 Upſal 2 21 U. 1 10 57 = D.M. 1 11 S.H. 8 17 12 1 10 8 18 22 Savile-Houſe. 0 1 10 Par. = ″8. 50
h ′ ″ 9 54 8 Tornea 3 5 T. 1 37 30 = D.M. 1 11 S.H. 8 16 38 1 54 8 18 22 Savile-Houſe. 0 1 44 Par. = ″7. 75	h ′ ″ 9 45 59 Abo 2 29 A. 1 29 0 = D.M. 1 11 S.H. 8 16 59 1 18 8 18 22 Savile-Houſe. 0 1 23 Par. = ″9. 04
h ′ ″ 9 23 40 Calmar 1 58 C. 1 6 5 = D.M. 1 11 S.H. 8 17 35 0 47 8 18 22 Savile-Houſe. 0 0 47 Par. = ″8. 50	h ′ ″ 9 28 52 Hernoſand 2 26 H. 1 11 42 = D. M. 1 11 S.H. 8 17 10 1 15 8 18 22 Savile-Houſe. 0 1 12 Par. = ″8. 16
h ′ ″ 14 11 34 Calcutta 2 22 C. 5 54 15 = D. M. 1 11 S.H. 8 17 19 1 11 8 18 22 Savile-houſe. 0 1 3 Par. = ″7. 54	h ′ ″ 9 30 10 Stokolm 2 18 S. 4 7 52 = D.M. 0 59 M. 13 38 2 1 19 13 39 38 Madraſs. 0 1 36 Par. = ″10. 33

h	′	″			′	″			
9	28	9	Upſal		2	21	U.		
4	9	51	= D. M.		0	59	M.		
13	38	0			1	22			
13	39	38	Madraſs.						
0	1	38							
				Par. =		″	10.	15	

h	′	″			′	″			
9	54	8	Tornea		3	5	T.		
3	43	18	= D. M.		0	59	M.		
13	37	26			2	6			
13	39	38	Madraſs.						
0	2	12							
				Par. =		″	8.	90	

h	′	″			′	″			
9	45	59	Abo		2	29	A.		
3	51	48	= D. M.		0	59	M.		
13	37	47			1	30			
13	39	38	Madraſs.						
0	1	51							
				Par. =		″	10.	48	

h	′	″			′	″			
9	23	40	Calmar		1	58	C.		
4	14	43	= D. M.		0	59	M.		
13	38	23			0	59			
13	39	38	Madraſs.						
0	1	15							
				Par. =		″	10.	80	

h	′	″			′	″			
9	28	52	Hernoſand		2	26	H.		
4	9	6	= D. M.		0	59	M.		
13	37	58			1	27			
13	39	38	Madraſs.						
0	1	40							
				Par. =		″	9.	77	

h	′	″			′	″			
14	11	34	Calcutta		2	22	C.		
0	33	27	= D. M.		0	59	M.		
13	38	7			1	23			
13	39	38	Madraſs.						
0	1	31							
				Par. =		″	9.	32	

h	′	″			′	″			
9	30	8	Stokolm		2	18	S.		
4	7	7	= D. M.		0	59	G. M.		
13	37	15			1	19			
13	38	30	G. Mount.						
0	1	15							
				Par. =		″	8.	07	

h	′	″			′	″			
9	28	9	Upſal		2	21	U.		
4	9	6	= D. M.		0	59	G. M.		
13	37	15			1	22			
13	38	30	G. Mount.						
0	1	15							
				Par. =		″	7.	77	

h	′	″		′	″
9	54	8	Tornea	3	5 T.
3	42	33	=D.M.	0	59 G.M.
13	36	41		2	6
13	38	30	G. Mount.		
0	1	49			

Par. = 7. 35

h	′	″		′	″
9	45	59	Abo	2	29 A.
3	51	3	=D.M.	0	59 G.M.
13	37	2		1	30
13	38	30	G. Mount.		
0	1	28			

Par. = 8 31

h	′	″		′	″
9	23	40	Calmar	1	58 C.
4	13	58	=D.M.	0	59 G.M.
13	37	38		0	59
13	38	30	G. Mount.		
0	0	52			

Par. = 7. 50

h	′	″		′	″
9	28	52	Hernoſ.	2	26 H.
4	8	21	=D.M.	0	59 G.M.
13	37	13		1	27
13	38	30	G. Mount.		
0	1	17			

Par. = 7. 52

h	′	″		′	″
14	11	34	Calcutta	2	22 C.
0	34	12	=D.M.	0	59 G.M.
13	37	22		1	23
13	38	30	G. Mount.		
0	1	8			

Par. = 6. 96

h	′	″		′	″
9	30	8	Stokolm	2	18 S.
4	6	50	= D. M.	0	51 T.
13	36	58		1	27
13	38	25	Tranquebar.		
0	1	27			

Par. = 8. 50

h	′	″		′	″
9	28	9	Upſal	2	21 U.
4	8	49	=D. M.	0	51 T.
12	36	58		1	30
13	38	25	Tranquebar.		
0	1	27			

Par. = 8. 23

h	′	″		′	″
9	54	8	Tornea	3	5 T.
3	42	16	= D. M.	0	51 T.
13	36	24		2	14
13	38	25	Tranquebar.		
0	2	1			

Par. = 7. 68

h	′	″			′	″	
9	45	59	Abo	2	29	A.
3	50	46	= D. M.	0	51	T.
13	36	45		1	38	
13	38	25	Tranquebar.			
0	1	40				

Par. = 8″. 67

h	′	″			′	″	
9	23	40	Calmar	1	58	C.
4	13	41	= D. M.	0	51	T.
13	37	21		1	7	
13	38	25	Tranquebar.			
0	1	4				

Par. = 8″. 12

The reſults are ſet down in the following table.

⊙'s Par.

	Stok.	Upſal.	Torn.	Cajan.	Tobo.	Abo.	Calm.	Hern	Calcu.	Mean.
Paris.	8″. 70	8″. 60	7″. 92	8″. 43	8″. 60	9″. 03	8″. 63	8″. 42	7″. 83	8″. 46
Greenwich.	9. 66	9. 61	8. 42	9. 09	9. 11	10. 04	10. 16	9. 20	8. 62	9. 32
Savile-Houſe.	8. 50	8. 50	7. 75	8. 50	8. 66	9. 04	8. 50	8. 16	7. 54	8. 36
Bologna.	8 65	8. 35	8. 23	8. 44	8. 58	8. 71	8. 31	8. 36	8. 28	8. 43
Madraſs.	10. 33	10. 15	8. 90	9. 71	9. 54	10. 48	10. 80	9. 77	9. 32	9. 89
Grand Mount.	8. 07	7. 77	7. 35	8. 07	8. 34	8. 31	7. 50	7. 52	6. 96	7. 76
Tranquebar.	8. 50	8. 23	7. 68	8. 36	8. 55	8. 67	8. 12	7. 96	7. 47	8. 17
Sun'sPar,mean.	8. 91	8. 75	8. 03	8. 66	8. 77	9. 18	8. 86	8. 48	8. 00	8. 63

The mean of theſe 63 reſults gives the Sun's parallax = 8″, 63; and if we reject all thoſe which differ more than one ſecond from the mean of the whole the mean of the remaining 49 reſults gives the Sun's parallax = 8″, 50.

And if we reject all thoſe which differ more than half a ſecond from the mean of the whole, the mean of the remaining 37 reſults gives the Sun's parallax = 8″, 535; the mean therefore of theſe three means gives the Sun's parallax = 8″, 55.

Thus

Thus by the mean of 53 compariſons the Sun's parallax is determined to be $= 8'', 58$, and by the mean of 63 compariſons the Sun's parallax is determined to be $= 8'', 55$. The mean of theſe two means gives $8'', 565$ for the parallax of the Sun on the day of the tranſit.

It may be objected, that this determination cannot be depended on to a very great preciſion, becauſe the greateſt difference of the effect of the parallaxes in any of theſe compariſons does not exceed $3' 31''$: conſequently that this is too ſmall a baſe, from which we can expect any great exactneſs in the determination of the Sun's parallax: But if we conſider the great number of compariſons (no leſs than 116), the certainty of the differences of longitude of moſt of the places of obſervation, and the ſmall differences in the reſults themſelves, I cannot help thinking that the force of this objection is in ſome meaſure removed; and that this determination of the Sun's parallax, by the obſervations at places on this ſide of the *Line* only, muſt be very near the truth.

In order, therefore, to remove the force of this objection entirely, let us next conſider the obſervation at the Cape of Good Hope, by which we ſhall have a baſe very near three times greater than the former, and alſo the obſervation at Rodrigues, by which the baſe is nearly double of the former. But before I proceed I muſt take notice, that, in the Memoir, by M. Pingré, before mentioned, the time of the internal contact at the egreſs at Rodrigues is ſet down at $0^h\ 36'\ 49''$. But in the ſame volume there is an account of M. Pingré's obſervation ſent to the R. Academy before his arrival in Europe, and the

time of the internal contact is therein ſet down at 0^h 34′ 47″. Alſo in a letter from him to the R. Society, on his arrival in Europe at Liſbon, and dated the 6th of March 1762, and which letter is printed in the Phil. Tranſactions, vol. LII. part I. the time of the internal contact is therein ſet down at 0^h 34′ 47″ true time. In another letter from him at Liſbon to the Royal Society, dated the 14th of March 1762, the time of the internal contact is again ſet down at 0^h 34′ 47″ true time, and he ends this letter in theſe words, " Notez que l'attouchement interne des Bords s'eſt faite à 0^h 34′ 47′. Je fais cette remarque, parceque, vû la proximité de prononciation, qui dans notre langue eſt entre 30 and 40, celle attouchement ſe trouvoit marqué 10″ plutot qu'il ne devoit l'être, dans une copie que j'ai faite pour mon uſage; cette erreur aura *peut etre* paſſé dans quelque autre copie. Mais, ſelon l'original, il faut abſolument lire 0^h 34′ 47″. M. Pingré has no where, that I can find, in the ſaid memoir given any reaſon for this alteration of the time of the contact. If the internal contact at the egreſs at Rodrigues happened at 0^h 34′ 47″, and if this is compared with the ſame obſervation at Tobolſk the parallax of the Sun comes out = 7″, 36. If the time of the contact at Rodrigues was at 0^h 35′ 47″, and if this is compared with the ſame obſervation at Tobolſk, then the parallax of the Sun is found = 8″, 62. Again if the time of the contact at Rodrigues was at 0^h 36′ 49″, and if this is compared with the obſervation at Tobolſk, the parallax of the Sun will be found = 9″, 93. But to return.

M. Pingré, in his letter to the Royal Society dated at Liſbon the 14th of March 1762, ſets down the time of the internal contact at the egreſs at 0^h 34′ 47″

true time, and with regard to the time of the external contact expreſſes himſelf thus "à 0^h $53'$ $18''$ le ſoleil a paru pendant 3 ou 4 ſecondes. Je n'ai pas vu le diſque du ſoleil bien fermé, il me paroiſſoit un peu alteré au lieu de la ſortie de Venus. M. Thuillier ne voyoit rien avec la Lunette de 9 peids. J'ai de la peine à me perſuader que Venus ſoit ſortie plutot." It is plain from theſe words that M. Pingré believed that the external contact did not happen before 0^h $53'$ $18''$. This being allowed, let us compute the duration of the egreſs at Rodrigues, which we ſhall find $= 17'$ $55''$. It follows, therefore, that the internal contact happened at 0^h $35'$ $23''$. But this ſuppoſes that the obſerver could ſee the very laſt contact of Venus with the Sun's limb, the contrary of which I have ſhewn in a former paper on this ſubject We are therefore certain that the external contact happened later than 0^h $53'$ $18''$, by ſeveral ſeconds, conſequently the internal contact happened later than 0^h $35'$ $23''$ by ſeveral ſeconds. Upon the whole, therefore, we may ſafely conclude that there is a miſtake of one minute in ſetting down the time of the internal contact at the egreſs at Rodrigues, and that, inſtead of 0^h $34'$ $47''$, it ſhould be 0^h $35'$ $47''$. This ſort of miſtake has happened ſeveral times in the obſervations of this tranſit, but they are eaſily diſcovered.

I ſhall now proceed to compare the obſervation of the internal contact at the Cape, with the obſervation of the ſame contact at Rodrigues and at 20 places to the north of the *Line*, and alſo the obſervation at Rodrigues with the ſame 20 places, and they are as follow.

h ′ ″		′ ″	h ′ ″		′ ″
9 39 50	Cape	6 8 C.	9 39 50	Cape	6 8 C.
2 59 7	= D. M.	2 59 R.	1 4 19	= D. M.	0 53 P.
12 38 57		3 9	8 35 31		7 1
12 35 47	Rodrigues.		8 28 27	Paris.	
0 3 10			0 7 4		
	Par. =	8. 54		Par. =	8. 56

h ′ ″		′ ″	h ′ ″		′ ″
6 39 50	Cape	6 8 C.	9 39 50	Cape	6 8 C.
0 28 14	= D. M.	0 29 B.	0 23 42	= D. M.	0 13 R.
9 11 36		6 37	9 16 8		6 21
9 4 57	Bologna.		9 9 36	Rome.	
0 6 39			0 6 32		
	Par. =	8. 54		Par. =	8. 74

h ′ ″		′ ″	h ′ ″		′ ″
9 39 50	Cape	6 8 C.	9 39 50	Cape	6 8 C.
0 29 31	= D. M.	0 24 F.	0 34 3	= D. M.	1 18 G.
9 10 19		6 32	9 5 47		7 26
9 3 28	Florence.		8 58 26	Gottingen.	
0 6 51			0 7 21		
	Par. =	8. 91		Par. =	8. 40

h ′ ″		′ ″	h ′ ″		′ ″
9 39 50	Cape	6 8 C.	9 39 50	Cape	6 8
1 13 35	= D. M.	1 12 G.	1 14 5	= D. M.	1 11 S.H.
8 26 15		7 20	8 25 45		7 19
8 19 0	Greenwich.		8 18 22	Savile-Houſe.	
0 7 15			0 7 23		
	Par. =	8. 40		Par. =	8. 57

h	′	″		′	″	
9	39	50	Cape	6	8	C.
1	32	7	= D. M.	1	4	L.
8	7	43		7	12	
8	0	21	Leſkeard.			
0	7	22				

Par. = 8. 69

h	′	″		′	″	
9	39	50	Cape	6	8	C.
0	8	0	= D. M.	1	59	C.
9	31	50		8	7	
9	23	40	Calmar.			
0	8	10				

Par. = 8 55

h	′	″		′	″	
9	39	50	Cape	6	8	C.
0	2	23	= D. M.	2	26	H.
9	37	27		8	34	
0	28	52	Hernoſand.			
0	8	35				

Par. = 8. 51

h	′	″		′	″	
9	39	50	Cape	6	8	C.
0	3	8	= D. M.	2	21	U.
9	36	42		8	29	
9	28	9	Upſal.			
0	8	33				

Par. = 8. 57

h	′	″		′	″	
9	39	50	Cape	6	8	C.
0	1	9	= D. M.	2	18	S.
9	38	41		8	26	
9	30	10	Stokolm.			
0	8	31				

Par. = 8. 58

h	′	″		′	″	
9	39	50	Cape	6	8	C.
0	14	55	= D. M.	2	30	A.
9	54	45		8	38	
9	45	59	Abo.			
0	8	46				

Par. = 8. 63

h	′	″		′	″	
9	39	50	Cape	6	8	C.
0	37	20	= D. M.	2	59	C.
10	17	10		9	7	
10	7	59	Cajaneburg.			
0	9	11				

Par. = 8. 56

h	′	″		′	″	
9	39	50	Cape	6	8	C.
0	23	25	= D. M.	3	5	T.
10	3	15		9	13	
9	54	8	Tornea.			
0	9	7				

Par. = 8. 41

h ′ ″ 9 39 50 Cape ′ ″ 6 8 C. 3 19 32 = D. M. 3 44 T. 12 59 22 9 52 12 49 23 Tobolſk. 0 9 59 Par. = ″ 8. 64	h ′ ″ 9 39 50 Cape ′ ″ 6 8 C. 4 40 10 = D. M. 2 22 C. 14 20 0 8 30 14 11 34 Calcutta. 0 8 26 Par. = ″ 8. 43
h ′ ″ 9 39 50 Cape ′ ″ 6 8 C. 4 6 43 = D. M. 0 59 M. 13 46 33 7 7 13 39 38 Madraſs. 0 6 55 Par. = ″ 8. 28	h ′ ″ 9 39 50 Cape ′ ″ 6 8 C. 4 5 58 = D. M. 0 59 G. M. 13 45 48 7 7 13 38 30 Grand Mount. 0 7 18 Par. = ″ 8. 70
h ′ ″ 9 39 50 Cape ′ ″ 6 8 C. 4 5 41 = D. M. 0 51 M. 13 45 31 6 59 13 38 25 Tranquebar. 0 7 6 Par. = ″ 8. 60	Rodrigues and the following places compared together.
h ′ ″ 12 35 47 Rodr. ′ ″ 2 59 R. 4 3 26 = D. M. 0 53 P. 8 32 21 3 52 8 28 27 Paris. 0 3 54 Par. = ′ 8. 58	h ′ ″ 12 35 47 Rodr. ′ ″ 2 59 R. 3 27 21 = D. M. 0 29 B. 9 8 26 3 28 9 4 57 Bologna. 0 3 29 Par. = ″ 8. 54

h ′ ″		′ ″
12 35 47	Rodr.	2 59 R.
3 22 49	= D. M.	0 13 R.
9 12 58		3 12
9 9 36	Rome.	
0 3 22		

Par. = 8. 94

h ′ ″		′ ″
12 35 47	Rodr.	2 59 R.
3 28 38	= D. M.	0 24 F.
9 7 9		3 23
9 3 28	Florence.	
0 3 41		

Par. = 9. 24

h ′ ″		′ ″
12 35 47	Rodr.	2 59 R.
3 33 10	= D. M.	1 18 G.
9 2 37		4 17
8 58 26	Gottingen.	
0 4 11		

Par. = 8. 30

h ′ ″		′ ″
12 35 47	Rodr.	2 59 R.
4 12 42	= D. M.	1 12 G.
8 23 5		4 11
8 19 0	Greenwich.	
0 4 5		

Par. = 8. 33

h ′ ″		′ ″
12 35 47	Rodr.	2 59 R.
4 13 12	= D. M.	1 11 S. H.
8 22 35		4 10
8 18 22	Savile-Houſe.	
0 4 13		

Par. = 8. 59

h ′ ″		′ ″
12 35 47	Rodr.	2 59 R.
4 31 14	= D. M.	1 4 L.
8 4 33		4 3
8 0 21	Leſkeard.	
0 4 12		

Par. = 8. 81

h ′ ″		′ ″
12 35 47	Rodr.	2 59 R.
3 7 7	= D. M.	1 59 C.
9 28 40		4 58
9 23 40	Calmar.	
0 5 0		

Par. = 8. 56

h ′ ″		′ ″
12 35 47	Rodr.	2 59 R.
3 1 30	= D. M.	2 26 H.
9 34 17		5 25
9 28 52	Hernoſand.	
0 5 25		

Par. = 8. 50

h ′ ″		′ ″
12 35 47	Rodr.	2 59 R.
3 2 15	= D. M.	2 21 U.
9 33 32		5 20
9 28 9	Upſal.	
0 5 23		
	Par. =	″ 8. 58

h ′ ″		′ ″
12 35 47	Rodr.	2 59 R.
3 0 16	= D. M.	2 18 S.
9 35 31		5 17
9 30 11	Stokolm.	
0 5 20		
	Par. =	″ 8. 58

h ′ ″		′ ″
12 35 47	Rodr.	2 59 R.
2 44 12	= D. M.	2 30 A.
9 51 35		5 29
9 45 59	Abo.	
0 5 36		
	Par. =	″ 8. 68

h ′ ″		′ ″
12 35 47	Rodr.	2 59 R.
2 21 47	= D. M.	2 59 C.
10 14 0		5 58
10 7 59	Cajaneburg.	
0 6 1		
	Par. =	″ 8. 57

h ′ ″		′ ″
12 35 47	Rodr.	2 59 R.
2 35 42	= D. M.	3 5 T.
10 0 5		6 4
9 54 8	Tornea.	
0 5 57		
	Par. =	″ 8. 33

h ′ ″		′ ″
12 35 47	Rodr.	2 59 R.
0 20 25	= D. M.	3 44 T.
12 56 12		6 43
12 49 23	Tobolſk.	
0 6 49		
	Par. =	″ 8. 62

h ′ ″		′ ″
12 35 47	Rodr.	2 59 R.
1 41 3	= D. M.	2 22 C.
14 16 50		5 21
14 11 34	Calcutta.	
0 5 16		
	Par. =	″ 8. 37

h ′ ″		′ ″
12 35 47	Rodr.	2 59 R.
1 7 36	= D. M.	0 59 M.
13 43 23		3 58
13 39 38	Madraſs.	
0 3 45		
	Par. =	″ 8. 03

h ′ ″		′ ″		h ′ ″		′ ″	
12 35 47	Rodr.	2 59	R.	12 35 47	Rodr.	2 59	R.
1 6 51	= D.M.	0 59	G.M.	1 6 34	= D.M.	0 51	T.
13 42 38		3 58		13 42 21		3 50	
13 38 30	Grand Mount.			13 38 25	Tranquebar.		
0 4 8				0 3 56			
	Par. =	8″. 85			Par. =	8″. 74	

The reſults of the Sun's parallax from theſe ſeveral compariſons are as follow.

	Sun's Parallax.		Sun's Parallax.
Cape of G. Hope and Rodrigues	= 8″. 54	Rodrigues and Cape of G. Hope	= 8″. 54
Paris	= 8. 56	Paris	= 8. 58
Bologna	= 8. 54	Bologna	= 8. 54
Rome	= 8. 74	Rome	= 8. 94 *r*.
Florence	= 8. 91 *r*.	Florence	= 9. 24 *r*.
Gottingen	= 8. 40	Gottingen	= 8. 30 *r*.
Greenwich	= 8. 40	Greenwich	= 8. 33 *r*.
Savile-Houſe	= 8. 57	Savile-Houſe	= 8. 59
Leſkeard	= 8. 69	Leſkeard	= 8. 81 *r*.
Calmar	= 8. 55	Calmar	= 8. 56
Hernoſand	= 8. 51	Hernoſand	= 8. 50
Upſal	= 8. 57	Upſal	= 8. 58
Stokolm	= 8. 58	Stokolm	= 8. 58
Abo	= 8. 63	Abo	= 8. 68
Cajaneburg	= 8. 58	Cajaneburg	= 8. 57
Tornea	= 8. 41	Tornea	= 8. 33 *r*.
Tobolſk	= 8. 64	Tobolſk	= 8. 62
Calcutta	= 8. 43	Calcutta	= 8. 37
Madraſs	= 8. 28 *r*.	Madraſs	= 8. 03 *r*.
G. Mount	= 8. 70	G. Mount	= 8. 85 *r*.
Tranquebar	= 8. 60	Tranquebar	= 8. 74

The mean of the 21 compariſons with the obſervation at the Cape, gives the Sun's parallax = 8″, 56. There are only two of theſe 21 compariſons, marked with the letter *r*, which differ more than $\frac{2}{10}$ of a ſecond from the mean of the whole; let theſe be rejected, and the mean of the remaining 19 reſults gives the Sun's parallax = 8″, 56.

If we ſelect out of theſe 21 compariſons thoſe places whoſe difference of longitude may be ſuppoſed to be the beſt determined, the mean of theſe may be regarded as the moſt exact determination, viz. Paris, Bologna, Greenwich, Savile-Houſe, Upſal, Stokolm, Cajaneburg and Tobolſk; the mean of theſe gives the Sun's parallax = 8″, 55, and if we leave out the reſults of Greenwich and Tobolſk, which differ the moſt from the reſt, the mean of the remaining 6 reſults gives it = 8″, 56 the ſame as before.

The mean of the 21 compariſons with the obſervation at Rodrigues gives the Sun's parallax = 8″, 57, and if we reject 8 of them, which are marked with the letter *r*, and which differ more than $\frac{2}{10}$ of a ſecond from the mean of the whole, the mean of the remaining 13 reſults gives the Sun's parallax 8″, 57, differing only one hundredth part of a ſecond from that which was determined from the obſervation at the Cape, and agreeing in a moſt ſurprizing manner with what was formerly determined by the compariſons of the the obſervations at places on this ſide of the *Line* only, where the baſe was ſo ſmall, as I ſaid before; a moſt convincing proof of the great preciſion with which the parallax of the Sun is determined by the late tranſit of Venus.

We ſhall now enquire into the limits of the error that may attend the determination of the parallax by the obſervation of the internal contact. An error of 1′ 10″ of time in the obſervation at Tobolſk when compared with the obſervation at the Cape, will produce an error of 1″ in the Sun's parallax: and if we ſuppoſe an error of 35″ of time in the obſervation

vation at Tobolſk, and an error of the ſame quantity in the obſervation at the Cape, and both in contrary directions, this alſo will produce an error of only 1″ in the Sun's parallax. If therefore no greater error could be committed in the obſervations at Tobolſk and the Cape, we are certain that the compariſon of Tobolſk and the Cape gives the Sun's parallax ſo exact, that the error does not exceed one ſecond from the true parallax. But this is too great an error to be ſuppoſed in the obſervations, becauſe I have ſhewn, in my former paper, that an error of only 6″ in time was committed in the obſervation of the contact by perſons obſerving even in the ſame place; therefore, if we ſuppoſe an error of 6″ of time in the obſervation at Tobolſk, and an error of the ſame quantity in the obſervation at the Cape, and both in contrary directions, the error produced in the parallax by thoſe 12″, will amount only to $\frac{1}{6}$ of a ſecond, even though we had only theſe two obſervations to determine the Sun's parallax: But ſince we have a great number of very good obſervations, made at other places, it follows that the mean of all theſe, muſt give the Sun's parallax to a leſs error than $\frac{1}{6}$ of a ſecond, and conſequently very near the truth.

In all places where the internal contact at the egreſs was obſerved, and where there were more obſervers than one, we find a difference in the time of each obſerver; the obſervation at Greenwich is an exception to this, as the three obſervers all agree to the ſame ſecond, in the obſervation of the contact of Venus with the Sun's limb; which is the more ſurprizing as they uſed teleſcopes of different conſtruc-

tions and of different magnifying powers. This coincidence not only ſurprized me, but alſo the reverend Mr. Hornſby, now Savilian profeſſor of Aſtronomy at Oxford. Mr. Hornſby went to Greenwich in the beginning of the year 1762, and on his return told me, that his ſurprize was at an end, for he had been informed at Greenwich, that Mr. Green, the aſſiſtant obſerver there, as ſoon as he judged that the internal contact was formed, called out *now*. This muſt certainly have cauſed ſome diſturbance to the other obſervers, and might poſſibly influence their judgment: and the fact (as I am informed) was that each obſerver had a ſecond watch in his hand, and they inſtantly ſtoped their watches, each having his hand at his watch ready to ſtop. This problem, therefore, is eaſily ſolved, and the ſurprize at the coincidence entirely vaniſhes; ſo that this obſervation can be looked on as no more than the obſervation of one perſon, and he too not much practiſed in obſerving. Moreover it is proper I ſhould obſerve that another perſon was preſent at this obſervation, who confirmed the above account.

The very near coincidence of the three obſervers at Greenwich, in the time of the external contact remains now to be accounted for. Mr. Green did not call out at this time, becauſe he was forbid by Dr. Bradley, who was preſent, though not in a condition to obſerve becauſe of his bad ſtate of health. This problem therefore may be ſolved in the following manner. The obſervation of the external contact was undoubtedly more uncertain than the former, and yet we find two of the obſervers agreeing to the ſame ſecond, and the third differing only one ſecond from them. If we attend to the following circum-

ſtances, we ſhall be immediately ſatisfied by them. Each obſerver had a ſecond-watch in his hand; the three obſervers were at the ſame window of the ſame room, one of them on the leads immediately without the window, and the other two within the window; therefore each obſerver was within hearing and ſeeing of each other; conſequently the inſtant one of the obſervers ſtopped his watch, may it not be preſumed that the noiſe of the nicking of it might be heard by the reſt? eſpecially as there was a profound ſilence during the time of the obſervation.

I have thought proper to take notice of theſe facts, becauſe ſeveral perſons both at home and abroad have expreſſed their ſurprize at this coincidence, and that ſuch an exactneſs may not be eſtabliſhed as a precedent in theſe ſort of obſervations; and becauſe I think it eſſentially neceſſary, in all ſorts of obſervations, eſpecially in one of ſo much importance in aſtronomy as this, that every the minuteſt circumſtance ſhould be particularly related.

We are now to find the limits of the error ariſing from the difference of longitude between Tobolſk and the Cape. I find that an error of $1'\ 10''$ in time in the difference of longitude between theſe two places will cauſe an error of $1''$ in the Sun's parallax. But as we are certain that this error in longitude does not take place; therefore we are certain that the error in the parallax is within one ſecond of the truth. The difference of longitude between the Cape of Good Hope and Paris is determined, both by the obſervations of M. de la Caille and Mr. Maſon; the difference of longitude between Paris and Upſal in Sweden is ſettled by the obſervations of Jupiter's

piter's firſt ſatellite, and the difference of longitude between Upſal and Tobolſk is ſettled, by the obſervations of the contact at the ingreſs at both places, by the method of M. Pingré above mentioned. Therefore the difference of longitude between the Cape and Tobolſk is very exactly ſettled, ſo exactly, that I am perſwaded that the error does not amount to 5 or 6 ſeconds. Therefore the error in the parallax ariſing from the error of the difference of longitude is extremely ſmall, ſcarcely amounting to $\frac{1}{12}$ part of a ſecond. Therefore we are certain that the error in the ſun's parallax ariſing both from the error of obſervation and the error of longitude does not exceed $\frac{1}{4}$ of a ſecond in the compariſon of the obſervations of the internal contact at Tobolſk and at the Cape, even though we had no more obſervations to determine the Sun's parallax; but the mean of a great many more muſt bring it very near the truth.

I now proceed to determine the parallax of the Sun from the total durations obſerved at different places. If therefore we compare the durations obſerved at Tobolſk, Cajaneburg, Abo, and Tornea, with the durations obſerved at Madraſs, Grand Mount and Tranquebar, which give the greateſt differences, the reſults of the Sun's parallax will be as follow.

	Sun's Par.	Difference of duration.
	″	′ ″
Toboliſk and Madraſs - - =	9. 61	2 50
G. Mount =	8. 33	2 27
Tranquebar =	8. 52	2 40
Cajaneburg and Madraſs =	10. 09 *r.*	1 49
G. Mount =	8. 00	1 26
Tranquebar =	8. 33	1 39
Abo and Madraſs - - - =	10. 66 *r.*	1 34
G. Mount =	8. 33	1 11
Tranquebar =	8. 60	1 24
Tornea and Madraſs - - =	9. 20	1 34
G. Mount - =	7. 00 *r.*	1 11
Tranquebar =	7. 50 *r.*	1 24

The mean of theſe 12 reſults gives the Sun's parallax = 8″, 68, and if we reject four of them, which are marked with the letter *r*, and which differ the moſt from the reſt, the mean of the remaining 8 gives the Sun's parallax = 8″, 61.

This determination of the Sun's parallax cannot be depended on to any great preciſion, becauſe of the ſmall differences between the durations compared, the greateſt of which amounts only to 2′ 50″, and alſo becauſe of the ſmall number of compariſons. It ſerves only to ſhew nearly what is the quantity of the Sun's parallax.

We are now to determine the limits of the error in the determination of the Sun's parallax by the durations obſerved at two different places. The greateſt difference of duration is between Toboliſk and Madraſs, which amounts only to 2′ 50″. If therefore

an error of 20″ in time is committed in the obſervations of the ingreſs and egreſs at both the places compared, this error of 20″ in time will cauſe an error of 1″ in the reſult of the Sun's parallax, and in the compariſons of thoſe places where the difference of duration is leſs, will occaſion a greater error, and therefore the determination of the parallax, by this method, cannot be depended on to any great exactneſs, becauſe of the ſmall differences of the durations compared. In this method, however, we are free from the uncertainty ariſing from the difference of longitude not being exactly known.

I now proceed to the determination of the Sun's parallax by the leaſt diſtance of the centers. There are come to my hands only two meaſurements of the greateſt diſtance of the limbs of the Sun and Venus, one at Tobolſk and the other at Rodrigues. I ſhall only conſider the meaſurement at Rodrigues, becauſe there ſeems to me to be ſome miſtake in the meaſurement at Tobolſk. If we ſuppoſe the Sun's parallax $= 8'', 5$, then the apparent middle of the tranſit happened at Rodrigues at $9^h\ 37'\ 30''$. There is a meaſurement by M. Pingré of the greateſt diſtance of the limbs at $9^h\ 38'\ 13''$, which is ſo near the middle of the tranſit that we may ſafely take this quantity, viz. $5'\ 54'', 6$ *, for the greateſt diſtance of the limbs of the Sun and Venus, and eſpecially as it is marked an exact obſervation. This meaſurement, therefore, gives the apparent leaſt diſtance of the centers of the

* I all along conſider the obſervation of M. Pingré at Rodrigues as it is printed, from his own letter, in the Philoſophical Tranſactions.

Sun

Sun and Venus at Rodrigues = 9′ 21″, 4. Suppoſing then this meaſurement to be exact, here follows an irrefragable argument, independent of all other methods, to prove that the parallax of the Sun is very nearly = 8″, 5. Let us ſuppoſe the Sun's parallax = 10″, and let us compute, by the following method, the apparent leaſt diſtance of the centers at Tobolſk; from thence we ſhall find that the geocentric leaſt diſtance of the centers at Tobolſk is 567″,416, and by the obſervation at Rodrigues the geocentric leaſt diſtance of the centers is = 572″,612, ſo that, on this ſuppoſition, we have two different geocentric leaſt diſtances of the centers, which being abſurd, it follows that the Sun's parallax is not 10″. Again let us ſuppoſe that the Sun's parallax is = 7″, we ſhall find that the geocentric leaſt diſtance of the centers by the obſervation at Tobolſk is = 575″, 356, and by the obſervation at Rodrigues it is = 569″, 248. Thus then, again, we have two different geocentric leaſt diſtances of the centers, which being abſurd, it follows that the parallax of the Sun is not 7″. Again if we ſuppoſe the Sun's parallax = 8″ or 9″, we ſhall find that the ſame abſurdity will follow, but in theſe two laſt ſuppoſitions we ſhall find that the differences of the geocentric leaſt diſtances of the centers are not ſo great as on the ſuppoſitions of 10″ and 7″, it therefore follows that the parallax of the Sun is leſs than 9″ and more than 8, and if we continue to reaſon in the ſame manner we ſhall find, that on the ſuppoſition that the Sun's parallax is = 8″, 5, the geocentric leaſt diſtances of the centers ſeverally found by the obſer-

vation at Tobolſk and at Rodrigues is very nearly the ſame, conſequently that the Sun's parallax is very nearly $= 8'', 5$. If we purſue this ſubject to a greater preciſion, and ſuppoſe that the meaſurement of the greateſt diſtance of the limbs of the Sun and Venus, taken by M. Pingré, to be perfectly exact, and compute on true * principles the apparent leaſt diſtances of the centers from the durations obſerved at the different places in the north (the method of which I ſhall afterwards give) the parallax of the Sun will come out as follows, when they are compared with that meaſured at Rodrigues :

Rodrigues	Cajan.	Calm.	Tobol.	Torn.	Upſal.	Stoko.	Abo.	Herno.
	8″, 60	8″, 58	8″, 65	8″, 48	8″, 60	8″, 40	8″, 63	8″, 55

The mean of theſe eight compariſons gives the Sun's parallax $= 8'', 56$ being the very ſame, as that which we found before by the compariſons of the internal contacts.

Again let us reduce the obſerved durations, at the following ſeveral places, to the center, on the ſuppoſition that the Sun's parallax is $= 8'', 56$ as in the following table,

Tobolſk.	Cajaneburg.	Tornea.
h ′ ″	h ′ ″	h ′ ″
5 48 53 = Obſ. Du.	5 49 54 = Obſ. Du.	5 50 9 = Obſ. Du.
0 9 6 = Parallax.	0 8 8 = Parallax.	0 8 3 = Parallax.
5 58 59 = Cent. D.	5 58 2 = Cent. D.	5 58 12 = Cent. D.

* I ſay on true principles, becauſe I have reaſon to think that there is a miſtake in the method given by M. Pingré in the aforeſaid Memoir.

Upſal.	Stokolm.	Abo.
h ′ ″	h ′ ″	h ′ ″
5 50 26=Obſ. Du.	5 50 42=Obſ. Du.	5 50 9=Obſ. Du.
0 7 36=Parallax.	0 7 37=Parallax.	0 7 49=Parallax.
5 58 2=Cent. D.	5 58 19=Cent. D.	5 57 58=Cent. D.

Hernoſand.	Calmar.	Calcutta.
h ′ ″	h ′ ″	h ′ ″
5 50 26=Obſ. Du.	5 50 39=Obſ. Du.	5 50 36=Obſ. Du.
0 7 39=Parallax.	0 7 24=Parallax.	0 7 35=Parallax.
5 58 5=Cent. D.	5 58 3=Cent. D.	5 58 11=Cent. D.

Madraſs.	Grand Mount.	Abo.
h ′ ″	h ′ ″	h ′ ″
5 51 43=Obſ. Du.	5 51 20=Obſ. Du.	5 51 33=Obſ. Du.
0 6 35=Parallax.	0 6 35=Parallax.	0 6 26=Parallax.
5 58 18=Cent. D.	5 57 55=Cent. D.	5 57 59=Cent. D.

The mean of theſe 12 central durations gives the mean central duration $= 5^h\ 58'\ 5''$; from this central duration, we ſhall find that the geocentric leaſt diſtance of the centers is $= 571''$, or $9'\ 31''$. Let us compare the above apparent leaſt diſtance of the centers meaſured at Rodrigues with this geocentric leaſt diſtance of the centers, and we ſhall find that the parallax of the Sun from thence reſulting is $=$ $8''$, 56 the ſame as before. Theſe reſults of the parallax, ariſing from the compariſons of the apparent leaſt diſtances of the centers, agreeing with the former determinations of the parallax by the internal contacts, are a proof of the accuracy of this meaſurement of the greateſt diſtance of the limbs made by M. Pingré at Rodrigues.

There are 12 places at which the total duration was obſerved, three of theſe had a northern parallax of latitude at the middle of the tranſit, the other nine had a ſouthern parallax of latitude; let the apparent leaſt diſtance of the centers at each place of obſervation be found, by the following method, let theſe be compared together, and we ſhall have the parallax of the Sun reſulting from them. For this purpoſe I have computed the apparent leaſt diſtance of the centers at the 8 following places, and have compared them with the apparent leaſt diſtance of the centers at the four following places, and from each compariſon I have computed the parallax of the Sun, and they are as in the following table.

	Cajan.	Calm.	Tobol.	Tornea	Upſal.	Stoko.	Abo.	Herno.	⊙'s Par. mean.
	″	″	″	″	″	″	″	″	″
Tranquebar	8. 48	8. 45	8. 54	8. 31	8. 48	8. 20	8. 52	8. 42	8. 42
Madraſs - -	8. 79	8. 76	8. 93	8. 61	8. 79	8. 50	8. 82	8. 73	8. 74
G. Mount -	8. 42	8. 38	8. 45	8. 24	8. 42	8. 12	8. 45	8. 35	8. 35
Calcutta - -	8. 69	8. 65	8. 81	8. 43	8. 68	8. 35	8. 73	8. 61	8. 62
⊙'sP.mean.	8. 59	8. 56	8. 68	8. 40	8. 59	8. 29	8. 63	8. 53	8. 53

The mean of theſe 32 compariſons gives the Sun's parallax = 8″, 53. This very near agreement with the former determinations is ſomewhat ſurprizing, when we conſider the ſmallneſs of the baſe from which they are computed, the greateſt ſcarcely exceeding 20″ of an angle; but we are alſo to conſider, that the apparent leaſt diſtance of the centers may be found, from the duration obſerved, to a very great exactneſs, and nothing affects the accuracy of it, but the errors in the obſervation. Let us ſuppoſe then that an error, of 6″ in time, happened in each of

of the obſervations of the ingreſs and egreſs, both in contrary directions; the ſum of the errors, therefore, in each compariſon, will amount to 24″ of time; this will produce an error of 1″ of ſpace in the apparent leaſt diſtance of the centers by computation, but this error of 1″ cannot produce an error of ſo much as half a ſecond in the determination of the Sun's parallax. It therefore follows, on the above ſuppoſition of an error of 24″ of time in the obſervation, that though we had no other obſervations of the tranſit of Venus than two of the above total durations, (ſuppoſe that of Cajaneburg and Madraſs) yet we ſhould have been abſolutely certain of the parallax of the Sun within leſs than an error of half a ſecond, and therefore of courſe it follows, that the mean of ſo great a number of reſults muſt be very near the truth.

This determination of the Sun's parallax, by the leaſt diſtance of the centers, is alſo a convincing proof that there is no miſtake in the obſervation of Mr. Maſon at the Cape, as alledged by M. Pingré, and that there muſt be a miſtake of 1′ in ſetting down the time of the internal contact at the egreſs at Rodrigues, notwithſtanding M. Pingré, in the aforeſaid memoir, prefers his obſervation to that of Mr. Maſon, becauſe, as he ſays, that after a ſtrict examination of all the circumſtances attending his obſervation, *he could not find any miſtake in it, but alſo becauſe he has proved that no miſtake could poſſibly be committed.* In this determination of the parallax by the apparent leaſt diſtance of the centers, we are not embarraſſed with an exact knowledge of the difference of longitude between the places compared, which therefore

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in ſome meaſure compenſates for the ſmalneſs of the baſe.

The ſame irrefragable argument, made uſe of in the apparent leaſt diſtance of the centers, meaſured at Rodrigues, to prove that the parallax of the Sun is very nearly $= 8'$, 5, may likewiſe be deduced from the apparent leaſt diſtance of the centers, computed from the total durations obſerved at theſe 12 places, but with more certainty; becauſe the determination of the apparent leaſt diſtances of the centers from the obſerved total durations may be depended on to a very great preciſion, but the ſame cannot be ſaid with regard to the apparent leaſt diſtance of the centers meaſured at Rodrigues: For M. Pingré tells us that he uſed a very good micrometer fitted to a refracting teleſcope of nine feet focus, the object-glaſs of which was but an indifferent one; and we are very certain, that in meaſuring, with a micrometer of this ſort, dark objects on a white field or ground, if the image is any way indiſtinct, the angle meaſured will be leſs than the true angle, and *vice verſa* when a bright object is meaſured on a dark ground; as a proof of this remark, we find that M. Pingré meaſured and found the diameter of Venus, when on the Sun, $= 54''$, 7, whereas we are certain that it was above $58''$, and therefore we may preſume that the meaſurements of the greateſt diſtance of the limbs might be greater than the true diſtance, and as a further proof of the uncertainty of the meaſurements made with this inſtrument we find that M. Pingré makes the diſtance of the limbs greateſt, ſeveral minutes after it was paſt the greateſt.

I ſhall

I ſhall now produce, at one view, the means of the ſeveral determinations of the Sun's parallax, by the before-mentioned three ſeveral methods, which will contain the ſubſtance of this whole paper.

1mo. The mean of 116 compariſons of the internal contacts obſerved at places to the north of the *Line* only, gives the Sun's parallax - - - - - - - - - - - -	= 8. 565
2do. The mean of 21 compariſons of the internal contacts, with that at the Cape, gives the Sun's parallax - - - - -	= 8. 56
3tio. The mean of 21 compariſons of the internal contacts with that at Rodrigues, gives the Sun's parallax - - - -	= 8. 57
4to. The mean of the compariſons of the total durations gives the Sun's parallax	= 8. 61
5to. The mean of the apparent leaſt diſtances of the centers compared with that meaſured at Rodrigues, gives the Sun's parallax - - - - - - - - - - - - - - -	= 8. 56
6to. The mean of the apparent leaſt diſtances of the centers by computation from the total durations compared together, gives the Sun's parallax - - - - - - - -	= 8. 53
The mean of theſe 6 means gives the Sun's parallax - - - - - - - - - - - -	= 8. 566
And if we reject the mean ariſing from the compariſons of the total durations, which is the leaſt certain, the mean of the other 5 means gives the Sun's parallax	= 8. 557

Thus

Thus is the Sun's parallax, on the day of the tranſit, concluded to be = 8″, 56, and that from three different modes of comparing together a great number of obſervations variouſly combined; the ſeveral reſults ſo nearly coinciding that to me it ſeems impoſſible, that the mean of them all can err $\frac{1}{10}$ of a ſecond, and that probably the error does not exceed $\frac{1}{100}$ part of the whole quantity, as the great Dr. Halley had, many years ſince, confidently preſaged *, and thereupon I cannot but congratulate our age and nation, particularly this ſociety on being enabled, through the royal munificence, to ſend fit obſervers to the Cape of Good Hope, whoſe poſition affords the largeſt baſe, and conſequently the ſafeſt foundation for the truth.

P. S. M. Pingré, in his aforeſaid memoir, ſeems to think that there muſt be ſome miſtake in Mr. Maſon's obſervation at the Cape, becauſe by comparing the obſervations of Jupiter's ſatellites made by Mr. Maſon at the Cape, with thoſe made by M. Meſſier at Paris, he finds the difference of longitude between theſe two places leſs by 1′ of time, than between Paris and the obſervatory of M. de la Caille at the Cape, and therefore imagines that Mr. Maſon's obſervatory was to the weſt of M. de la Caille's. If M. Pingré had looked into the map of the Cape by M de la Caille, he would have ſeen, that, if Mr. Maſon's obſervatory had been 1′ of time to the weſt

* Ut junioribus noſtris aſtronomis, quibus forſan hæc obſervare, ob minorem ætatem, obtingere poteſt, viam præmonſtrem, qua immenſam ſolis diſtantiam, intra quingenteſimam ſui partem, rite dimetiri poterint. Ph. Tr. N. cccxlviii. p. 454.

of

of M. de la Caille's, it muſt have been in the ocean. I am not at all ſurprized to ſee a difference or error of 1′ of time in deducing the difference of longitude between Paris and the cape, by comparing Mr. Maſon's obſervations with thoſe of M. Meſſier; for I find, in the laſt volume of the Memoirs for 1761, a difference of 1′ 5″ between M. de la Lande and M. Meſſier in an immerſion of the firſt ſatellite of Jupiter, both of theſe gentlemen obſerving at Paris, owing I ſuppoſe to the different goodneſs of the teleſcopes uſed on this occaſion, for M. de la Lande ſays that he uſed an 18 foot refracter, the object-glaſs of which was tolerably good, and that M. Meſſier made uſe of a very good reflecter of 30 inches. If M. Pingré will take the trouble of looking into the Philoſophical Tranſactions, *vol. LII. part I.* he will there find obſervations made at the Cape, and in Surrey-ſtreet, London, of the immerſions of the firſt and ſecond ſatellites of Jupiter with reflecting teleſcopes, of equal goodneſs, of two feet focal length, where the difference of determination of the longitude of theſe two places, does not exceed one ſecond in thoſe of the firſt ſatellite, and not above 16″ in thoſe of the ſecond ſatellite. Mr. Maſon's obſervatory at the Cape was about half a mile to the ſouth of M. de la Caille's, and about 10 or 12 yards to the weſt of the meridian of the ſame.

M. Pingré alſo ſeems to think that the time ſhewn by Mr. Maſon's clock was taken from a falſe meridian. When M. Pingré ſhall read the account given by Mr. Maſon of his obſervations at the Cape, which he ſays in his Memoir he has not ſeen, I am perſwaded he will be fully ſatisfied, from the many e-

qual-altitudes taken by Mr. Maſon, that there can be no doubt of the times of his obſervations being found from a true meridian.

I cannot leave this ſubject without taking notice of a remarkable expreſſion in the hiſtory of the Memoirs of the R. Academy at Paris page 96, for the year 1757. It is there ſaid that the Engliſh intended to ſend an aſtronomer to North America to obſerve the tranſit of Venus (according to the plan laid down by Dr. Halley) before they ſaw the map of the tranſit by M. de L'iſle, and the authority produced for this aſſertion, are the Engliſh news papers, which, if they had underſtood the nature of theſe papers, can be no authority at all. I muſt therefore, on the beſt authority, inform the gentlemen, who are the compilers of the hiſtory of theſe memoirs, that the R. Society never once thought of ſending an obſerver to North America, even before they ſaw the map of the tranſit by M. de L'iſle.

N. B. In this paper I have employed the ſame elements as in my former paper on this ſubject, except that in reducing time to ſpace I have made uſe of 4′ 0″, 03 for the horary motion of Venus in her path.

A method

A method of determining the apparent leaſt diſtance of the centers of the Sun and Venus from the obſervation of the total duration of the tranſit obſerved any one place, and alſo the geocentric leaſt diſtance of the centers.

LET BCPL [Tab. XVII. Fig. 1.] repreſent the diſk of the Sun, LSP the ecliptic, OR the geocentric path of Venus over the Sun, AD the apparent path at any place, to the north of the plane of Venus's orbit, SM the geocentric leaſt diſtance of the centers, AK the parallax of latitude at the internal contact at the ingreſs, ND the parallax of latitude at the internal contact at the egreſs, A*b* the parallax of longitude at the ingreſs, and *c*D the parallax of longitude at the egreſs. It is required to find SF, which is a perpendicular let fall from the center of the Sun on the apparent path, and from thence to find SM the geocentric leaſt diſtance of the centers of the Sun and Venus.

If the parallax of longitude at the ingreſs retards, and the parallax of longitude at the egreſs accelerates, the total duration will be ſhortned by the ſum of theſe two parallaxes of longitude, viz. by A*b* and *c*D, and if we make no allowance for theſe parallaxes, the apparent path will appear to have been BC, conſequently a perpendicular from the center of the Sun on BC will be SE, longer than the perpendicular on the true apparent path by FE. But ſince it is certain that the parallaxes of longitude do not depreſs or elevate the planet, and only alter the po-

ſition of the planet in a direction perpendicular to the axis of the orbit of the planet, therefore the parallaxes of longitude, in time, are, in this caſe, to be added to the obſerved time of the total duration; in conſequence of which the obſerved time of total duration, $bc + Ab + cD$ are $=$ to the chord deſcribed by the planet in its paſſage over the Sun; and if the ſemidiameters of the Sun and Venus are known, their difference is known, which is $=$ to the line AS; AF, from what has been ſaid is alſo known, therefore SF may be found. But this SF is not the apparent leaſt diſtance of the centers, for if we compute the parallax of latitude for the apparent middle of the tranſit, we ſhall find it greater than MF, which MF is only a mean between the parallaxes of latitude at the ingreſs and egreſs. Let therefore the difference between MF and the parallax of latitude computed for the middle of the tranſit be added to SF, and the ſum will be $=$ to the apparent leaſt diſtance of the centers nearly; and if from this ſum we ſubtract the parallax of latitude, computed for the middle of the tranſit, the remainder will be the geocentric leaſt diſtance of the centers nearly.

A true and more ready method to find the geocentric leaſt diſtance of the centers, conſequently the apparent leaſt diſtance of the centers at any place, where the total duration has been obſerved.

Reduce the total duration obſerved to the center, reduce the central ſemi-duration, in time, into ſpace; then in the right-angled triangle SMA [Fig. 2.] or SM*a*, we have the two ſides SA or S*a*, and AM

or

or aM given, therefore the third ſide SM may be found, therefore SM the geocentric leaſt diſtance of the centers is found; and if to SM, we add or ſubtract the parallax of latitude for the apparent middle of the tranſit, the ſum or difference will be the apparent leaſt diſtance of the centers.

EXAMPLE.

To find the apparent leaſt diſtance of the centers at Tobolſk.

The total duration obſerved at Tobolſk was $5^h\ 48'\ 53''$ add $9'\ 3''$ (= to the effect of the parallaxes of longitude and latitude both for the ingreſs and egreſs, on the ſuppoſition that the Sun's parallax is $= 8'', 5$) to this total duration, the ſum $5^h\ 57'\ 56''$ is = to the central duration, conſequently $2^h\ 58'\ 58''$ is = the central ſemi-duration: reduce this time into ſpace, and it will be found = to $715'', 956$ = AM or aM, and SA or Sa (= difference of the ſemi-diameters of the Sun and Venus) $= 916''$, therefore SM will be found = $571'', 37$ = the geocentric leaſt diſtance of the centers of the Sun and Venus. The parallax of latitude, computed on the above ſuppoſition of the Sun's parallax, for the apparent middle of the tranſit at Tobolſk, will be found = $14'', 13$, which being added to the geocentric leaſt diſtance of the centers above found, the Sum $585'', 50$ will be the apparent leaſt diſtance of the centers at Tobolſk.

Fig. 1.

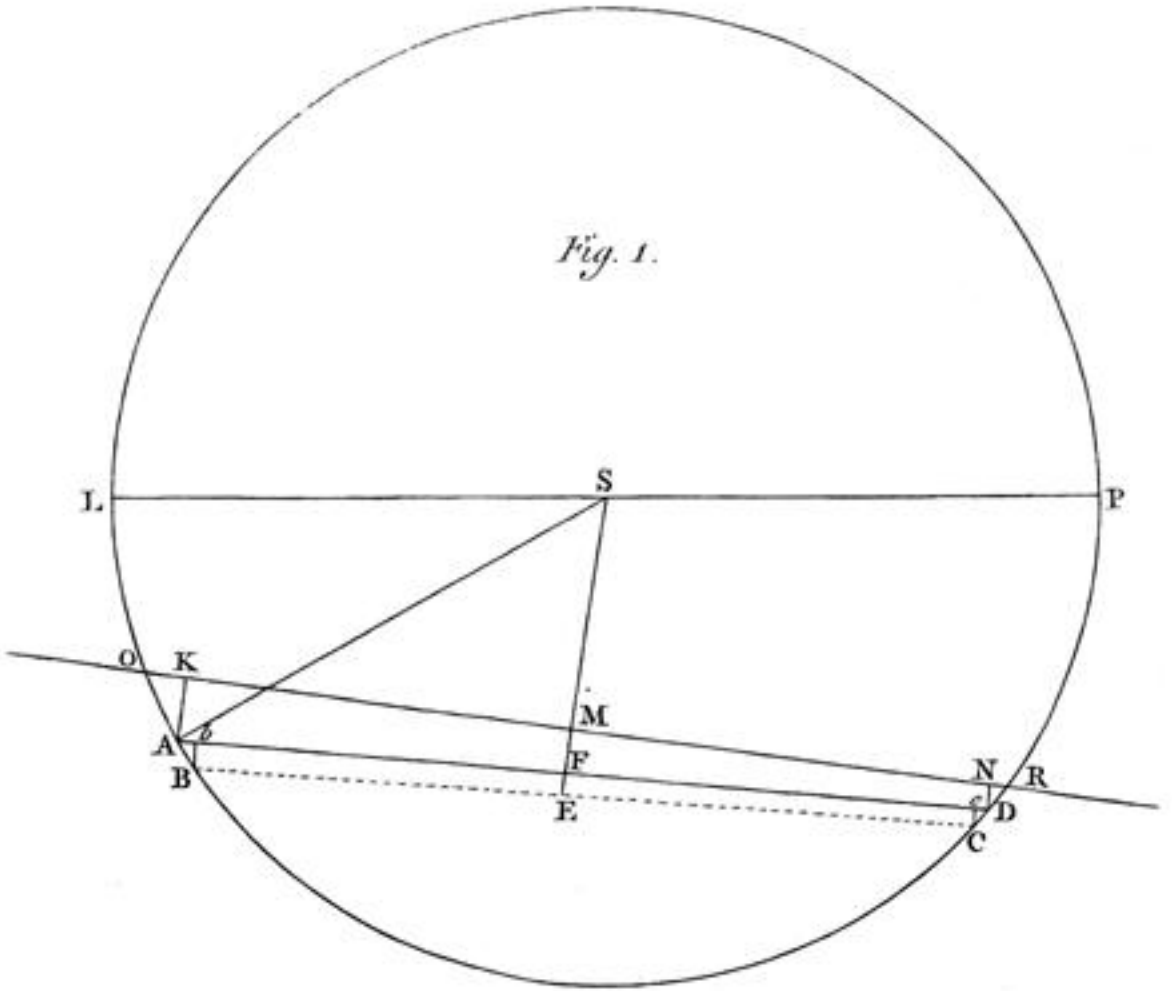

Fig. 2.